

# NISTTech

## Zig-Zag Shape Biased Anisotropic Magneto-Resistive Sensor

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**Tiny, low cost device to measure magnet fields**

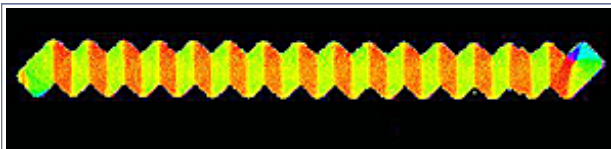
### Description

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These sensors, 35 micrometers long and 5 micrometers wide, are made of a thin film of nickel and iron, with nanoscale design elements at the edges. Tiny magnetic sensors in a "zigzag" shape measure slight fluctuations in current, and produce the equivalent of many tiny bar magnets oriented with their north and south poles at a 45-degree angle to the centerline of the sensor. The device senses magnetic fields using a small electrical current sent down the centerline. Tiny changes in the magnetic field surrounding the sensor—such as when a steel weapon passes near it—will increase the resistance to the current and will be detected as an increase in voltage. The device produces clearer signals by confining the current to the center of the device and by eliminating edge imperfections that can result in nanoscale magnetic fluctuations.

### Images

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The green and orange areas of the sensors act like tiny bar magnets with their north and south poles at a 45-degree angle to the centerline of the sensor.

### Applications

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- **Homeland defense**  
Detect weapons or vehicles.
- **Navigation**  
Improve compasses.
- **Medicine**  
Compact, clear medical sensors.
- **Construction**  
Non-destructive evaluation of structural materials.

### Advantages

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- **Clear signals**  
Reduces electronic noise.
- **Simple design**  
Inexpensive compared to conventional magnetic sensors used in portable devices.

## Abstract

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A magnetoresistive sensing apparatus is disclosed, comprising a magnetic film having a zig-zag shaped structure, a central axis, and a magnetization associated with the magnetic film, wherein the zig-zag shaped structure biases the magnetization direction alternately at positive and negative angles thereof, thereby permitting the magnetoresistive sensing apparatus to be sensitive to a magnetic field parallel to the axis of the magnetoresistive sensing apparatus and insensitive to magnetic fields perpendicular to the axis.

## Inventors

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## Citations

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1. F.C.S. da Silva, W.C. Uhlig, A.B. Kos, S. Schima, J. Aumentado, J. Unguris, and D. P. Pappas. Zigzag-shaped magnetic sensors. Applied Physics Letters, Vol. 85, pp. 6025-6027, December 13, 2004.

## Related Items

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- Article: Novel ZigZag Shape Gives Sensors Magnetic Appeal
- Article: New Technique Finds Lost data

## References

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- U.S. Patent #7,450,353
- Docket: 04-009US

## Status of Availability

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This invention is available for licensing.

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